

PATENT ABSTRACTS OF JAPAN

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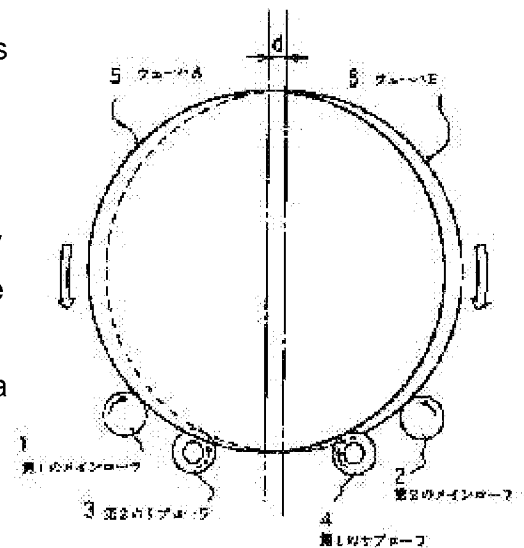
(72)Inventor : HIRAISHI YOSHINOBU

(54) WAFER ETCHING METHOD AND DEVICE

(57)Abstract:

PROBLEM TO BE SOLVED: To enable even a wafer of large diameter to be etched uniformly at a high etching rate by a method wherein wafers are arranged in an etchant in a direction vertical to their surfaces making their main surfaces vertical in a position, and the adjacent wafers are rotated in opposite directions respectively.

SOLUTION: The peripheral edge of a wafer A5 whose center is offset by (d) from that of a wafer B6 is supported with a main roller 1 and the large diameter part 4d of a sub-roller 4, the peripheral edge of the wafer B6 is supported with a second main roller 2 and the large diameter part 3d of a second sub-roller 3 at right angles with their main surfaces. When the first main roller 1 and the first sub-roller 4 are rotated in a positive direction and the second main roller 2 and the second sub-roller 3 are rotated in an opposite direction, the wafers A5 and B6 are rotated in opposite directions, respectively. Therefore, the momentum of etchant is canceled with each other at a center between the wafers A5 and B6, so that etchant is easily circulated between the wafers A5 and B6.



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CLAIMS

[Claim(s)]

[Claim 1]An etching method of a wafer characterized by comprising the following.

A process of making the principal surface vertical and arranging a wafer of plurality [inside / of an etching reagent] in the direction vertical to the principal surface.

A process of making a hand of cut of each arranged wafer with an opposite direction, and etching it about an adjacent wafer.

[Claim 2]It is an etching device of a wafer which etches by rotating a wafer vertically in support of the principal surface in etching ** filled up with an etching reagent, The 1st main roller arranged in said etching **, and the 2nd main roller, In support of a periphery of a wafer into which a larger diameter part and a small diameter part should be provided in shaft orientations by turns, and it should be etched by the larger diameter part and 1st main roller, the 1st pivotable sub roller, And a small diameter part and a larger diameter part are provided in shaft orientations by turns with appearance patterns contrary to it of the 1st sub roller, In support of a peripheral part of another wafer into which it should be etched by the larger diameter part and 2nd main roller, said each roller of each other is arranged in parallel including the 2nd pivotable sub roller, Out of a rotational area of a wafer in which support rotation should be carried out by larger diameter part of the 1st main roller and 1st sub roller, a small diameter part of the 2nd sub roller, Where it was located outside a rotational area of another wafer by which support rotation should be carried out and a wafer is supported by a larger diameter part of the 2nd main roller and 2nd sub roller, a small diameter part of the 1st sub roller at least one side of the 1st main roller and 1st sub roller for Masakata, A wafer by which support rotation is carried out with the 1st main roller and 1st sub roller when an opposite direction is made to rotate at least one side of the 2nd main roller and 2nd sub roller, An etching device of a wafer constituting so that another wafer by which support rotation is carried out with the 2nd main roller and 2nd sub roller may rotate to a counter direction mutually.

[Claim 3]An etching device of the wafer according to claim 2 establishing a wafer support groove in a larger diameter part of said 1st main roller, the 2nd main roller, and the 1st sub roller, and a larger diameter part of the 2nd sub roller.

[Claim 4]An etching device of the wafer according to claim 2 or 3 providing a support disk which stabilizes rotation of a wafer in contact with a rotational area of a wafer apart from said each roller.

[Claim 5]An etching device of the wafer according to any one of claims 2 to 4 providing a wafer position arrangement member between rotational areas of a ***** wafer.

[Claim 6]It is an etching device of a wafer which etches by rotating a wafer vertically in support of the principal

surface in etching ** filled up with an etching reagent, The 1st main roller that has been arranged in said etching ** and with which a larger diameter part and a small diameter part were provided in shaft orientations by turns, And the 2nd main roller with which a small diameter part and a larger diameter part were provided in shaft orientations by turns with appearance patterns contrary to it of the 1st main roller, A larger diameter part and a small diameter part are provided in shaft orientations by turns with the same appearance patterns as the 1st main roller, In support of a periphery of a wafer into which it should be etched by the larger diameter part and larger diameter part of the 1st main roller, the 1st pivotable sub roller, And a small diameter part and a larger diameter part are provided in shaft orientations by turns with the same appearance patterns as the 2nd main roller, In support of a peripheral part of another wafer into which it should be etched by the larger diameter part and larger diameter part of the 2nd main roller, said each roller of each other is arranged in parallel including the 2nd pivotable sub roller, Out of a rotational area of a wafer by which support rotation should be carried out, it of a small diameter part of the 2nd main roller, and the 2nd sub roller by a larger diameter part of the 1st main roller, and it of the 1st sub roller again, It of a small diameter part of the 1st main roller and the 1st sub roller is located outside a rotational area of another wafer in which support rotation should be carried out by a larger diameter part of the 2nd main roller, and it of the 2nd sub roller, Where a wafer is supported, at least one side of the 1st main roller and 1st sub roller for Masakata, A wafer by which support rotation is carried out with the 1st main roller and 1st sub roller when an opposite direction is made to rotate at least one side of the 2nd main roller and 2nd sub roller, An etching device of a wafer constituting so that another wafer by which support rotation is carried out with the 2nd main roller and 2nd sub roller may rotate to a counter direction mutually.

[Claim 7]An etching device of the wafer according to claim 6 establishing a wafer support groove in a larger diameter part of said 1st main roller, a larger diameter part of the 2nd main roller, a larger diameter part of the 1st sub roller, and a larger diameter part of the 2nd sub roller.

[Claim 8]An etching device of the wafer according to claim 6 or 7 providing a support disk which stabilizes rotation of a wafer in contact with a rotational area of a wafer apart from said each roller.

[Claim 9]An etching device of the wafer according to any one of claims 6 to 8 providing a wafer position arrangement member between rotational areas of a ***** wafer.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]This invention relates to the etching method and device in the manufacturing process of semiconductor wafers, such as silicon, and relates to the etching method and etching device of a wafer after wrapping as which precise etching is required especially.

[0002]

[Description of the Prior Art]As this seed etching method and conventional technology about a device, there are the semiconductor substrate etching method and device which are indicated by the Patent Publication Heisei No. 502148 [eight to] gazette, for example. If it was in this seed etching conventionally as indicated here, it arranged so that many wafers might be vertically stood on a roller shaft, and the wafer was rotated to the circumference of an axis parallel to a roller shaft by rotating a roller shaft. It is for stirring the etching reagent near a wafer surface, making a resultant dissipate promptly, or supplying a new etching reagent near a wafer surface, and making an etch rate uniform in that field to rotate the wafer which should be etched into this appearance.

[0003]However, major-diameter-ization of a wafer progresses in recent years and the arrangement interval of a wafer is becoming small as compared with a wafer diameter. For this reason, the etching reagent inserted into the wafer which rotates to a uniform direction rotates united with a wafer, and it becomes difficult to mix it with the surrounding etching reagent. Therefore, in the etching reagent inserted into the wafer, change arises to the concentration to wafer diameter directions which contribute to reactions, such as etching, such as fluoric acid and nitric acid, and the etching quantity of a wafer becomes uneven.

[0004]In the next mirror-polishing process, in order to produce the wafer in which the latest high display flatness is demanded since unevenness of the wafer surface by the unevenness of etching produced at this time is uncorrectable, improving the homogeneity of etching is called for strongly.

[0005]

[Problem(s) to be Solved by the Invention]With the art of an indication, in the above-mentioned Patent Publication Heisei No. 502148 [eight to] gazette. The revolving speed of a wafer shall be 5 rpm or less, it is made for the flow of the etching reagent through which it circulates to enter easily between wafers, and phosphoric acid is mixed in an etching reagent, viscosity is raised, and uniform etching is enabled also at small number of rotations by lowering an etch rate. However, in this method, there was a problem that an etch rate fell and productivity did not go up.

[0006]This invention cancels the fault of the above-mentioned conventional technology, and can realize a high etch rate also to the wafer put in order at the interval small moreover with the wafer of the major diameter, and an object of this invention is to provide the method and device for aiming at improvement in productivity.

[0007]

[Means for Solving the Problem]To achieve the above objects, in an etching method of a wafer of this invention, It is characterized by including a process of making a hand of cut of a process of making the principal surface vertical and arranging a wafer of plurality [inside / of an etching reagent] in the direction vertical to the principal surface, and each arranged wafer, with an opposite direction, and etching it about an adjacent wafer.

[0008]The 1st of an etching device of a wafer by this invention, It is an etching device of a wafer which etches by rotating a wafer vertically in support of the principal surface in etching ** filled up with an etching reagent, The 1st main roller arranged in said etching **, and the 2nd main roller, In support of a periphery of a wafer into which a larger diameter part and a small diameter part should be provided in shaft orientations by turns, and it should be etched by the larger diameter part and 1st main roller, the 1st pivotable sub roller, And a small diameter part and a larger diameter part are provided in shaft orientations by turns with appearance patterns contrary to it of the 1st sub roller, In support of a peripheral part of another wafer into which it should be etched by the larger diameter part and 2nd main roller, said each roller of each other is arranged in parallel including the 2nd pivotable sub roller, Out of a rotational area of a wafer in which support rotation should be carried out by larger diameter part of the 1st main roller and 1st sub roller, a small diameter part of the 2nd sub roller, By a larger diameter part of the 2nd main roller and 2nd sub roller, a small diameter part of the 1st sub roller is located outside a rotational area of another wafer by which support rotation should be carried out, and This sake, Where a wafer is supported, at least one side of the 1st main roller and 1st sub roller for Masakata, When an opposite direction is made to rotate at least one side of the 2nd main roller and 2nd sub roller, a periphery of a wafer which rotates on the 1st main roller and the 1st sub roller, A periphery of another wafer which is maintained at the 2nd main roller and 2nd sub roller, and noncontact state, and rotates on the 2nd main roller and the 2nd sub roller, It is too maintained at a noncontact state with the 1st main roller and the 1st sub roller. It is characterized by constituting so that a wafer by which support rotation is carried out with the 1st main roller and 1st sub roller, and another wafer by which support rotation is carried out with the 2nd main roller and 2nd sub roller may rotate to a counter direction mutually.

[0009]In the 1st of an etching device of the above-mentioned wafer, the 1st main roller, When a wafer support groove is established in a larger diameter part of the 2nd main roller and the 1st sub roller, and a larger diameter part of the 2nd sub roller, respectively, it is stabilized, rotation of a wafer can be performed smoothly and it is desirable. It is also good to provide a support disk for preventing deflection of a wafer in contact with a wafer rotational area in addition to a roller respectively. Corresponding to each wafer, one axis can be made to be able to achieve individual independence just like a bead, and a support disk can be provided in it. Of course, the guide rail same also to a periphery of a support disk as said wafer support groove should be provided. In order to rotate a wafer stably, a wafer position arrangement member can also be provided between rotational areas of a wafer (i.e., between phase next door **** wafers).

[0010]Next, the 2nd of a wafer etching device by this invention, It is an etching device of a wafer which etches by rotating a wafer vertically in support of the principal surface in etching ** filled up with an etching reagent, The 1st main roller that has been arranged in said etching ** and with which a larger diameter part and a small

diameter part were provided in shaft orientations by turns, And the 2nd main roller with which a small diameter part and a larger diameter part were provided in shaft orientations by turns with appearance patterns contrary to it of the 1st main roller, A larger diameter part and a small diameter part are provided in shaft orientations by turns with the same appearance patterns as the 1st main roller, In support of a periphery of a wafer into which it should be etched by the larger diameter part and larger diameter part of the 1st main roller, the 1st pivotable sub roller, And a small diameter part and a larger diameter part are provided in shaft orientations by turns with the same appearance patterns as the 2nd main roller, In support of a peripheral part of another wafer into which it should be etched by the larger diameter part and larger diameter part of the 2nd main roller, said each roller of each other is arranged in parallel including the 2nd pivotable sub roller, Out of a rotational area of a wafer in which support rotation should be carried out by a larger diameter part of the 1st main roller, and it of the 1st sub roller, it of a small diameter part of the 2nd main roller, and the 2nd sub roller, By a larger diameter part of the 2nd main roller, and it of the 2nd sub roller, it of a small diameter part of the 1st main roller and the 1st sub roller is located outside a rotational area of another wafer by which support rotation should be carried out, and This sake, Where a wafer is supported, at least one side of the 1st main roller and 1st sub roller for Masakata, When an opposite direction is made to rotate at least one side of the 2nd main roller and 2nd sub roller, even if it coincides a center of rotation of all the wafers, A periphery of a wafer which rotates on the 1st main roller and the 1st sub roller, A periphery of another wafer which is maintained at the 2nd main roller and 2nd sub roller, and noncontact state, and rotates on the 2nd main roller and the 2nd sub roller, A wafer by which support rotation is carried out with the 1st main roller and 1st sub roller while it had been too maintained at a noncontact state with the 1st main roller and the 1st sub roller, It is characterized by constituting so that another wafer by which support rotation is carried out with the 2nd main roller and 2nd sub roller may rotate to a counter direction mutually.

[0011]Even if it is in the 2nd of an etching device of the above-mentioned wafer, it is desirable when a wafer support groove is established in a larger diameter part of the 1st main roller, a larger diameter part of the 2nd main roller, a larger diameter part of the 1st sub roller, and a larger diameter part of the 2nd sub roller, respectively. It is also good to provide a support disk for preventing deflection of a wafer in contact with a wafer rotational area in a similar manner in addition to a roller respectively. In order to rotate a wafer stably, a wafer position arrangement member can also be provided between rotational areas of a wafer (i.e., between phase next door **** wafers).

[0012]

[Embodiment of the Invention]Below, an embodiment of the invention is described taking a drawing into consideration, and an understanding of this invention is presented with it. In this invention method, although it is the method of making a hand of cut with an opposite direction in the adjacent wafer comrade, the wafer arranged in on a rotary roller, [many] Drawing 1 is a front view showing a 1st embodiment of this invention device, and the 1st parallel main roller 1 and 2nd main roller 2 of each other are allocated in both sides, respectively. The 2nd parallel sub roller 3 and 1st sub roller 4 of each other are allocated by right and left inside the 1st and 2nd main roller of the above, respectively. As shown in drawing 2, the larger diameter parts 4d and 3d and the small diameter parts 4s and 3s are arranged at this 1st and 2nd sub roller. And this the 1st and 2nd larger diameter part and small diameter part of the sub roller are mutually provided with reverse appearance patterns, and, moreover, 3 s of small diameter parts of the 2nd sub roller 3, By the larger diameter part 4d of the 1st main roller 1 and 1st sub roller 4, it is located outside the rotational area of wafer A5 by which

support rotation is carried out, and 4 s of small diameter parts of the 1st sub roller 4, It is located outside the rotational area of wafer B6 in which support rotation is carried out by the larger diameter part 3d of the 2nd main roller 2 and 2nd sub roller 3. As shown in drawing 1 and drawing 2, the center wafer A5 and wafer B6 from which only d shifted the periphery, If it is in wafer A5, in the larger diameter part 4d of the 1st main roller 1 and 1st sub roller 4. It is supported by the larger diameter part 3d of the 2nd main roller 2 and 2nd sub roller 3 if it is in wafer B6, the 1st main roller 1 and 1st sub roller 4 -- for Masakata (clockwise rotation) -- if an opposite direction (counter clockwise) is made to rotate the 2nd main roller 2 and 2nd sub roller 3, respectively, wafer A5 and wafer B6 are constituted so that it may rotate to a counter direction mutually.

[0013]Next, although the front view of a 2nd embodiment of this invention device is shown in drawing 3, the top view is shown in drawing 4, and the allocation condition of each roller of this 2nd embodiment is the same as that of a 1st embodiment of the above, the larger diameter part and the small diameter part are provided also in the 1st main roller 1 and the 2nd main roller 2. That is, as shown in drawing 4, the larger diameter part 1d and 1 s of small diameter parts are provided in the shaft orientations by turns at the 1st main roller 1, and 2 s of small diameter parts and the larger diameter part 2d are formed in the shaft orientations with appearance patterns with the 1st reverse main roller 1 at the 2nd main roller 2. And the 1st and 2nd larger diameter parts 4d and 3d and small diameter parts 4s and 3s of the sub rollers 4 and 3 are provided with the respectively same appearance patterns as the larger diameter parts 1d and 2d of the 1st and 2nd main roller 1 and 2, and the small diameter parts 1s and 2s. As shown in drawing 3, in this 2nd embodiment. The center of wafer A5 and wafer B6 corresponds (shifting, of course is also possible), The periphery is supported by the larger diameter part 1d of the 1st main roller 1, and the larger diameter part 4d of the 1st sub roller 4, wafer B6 is supported by the larger diameter part 2d of the 2nd main roller 2, and the larger diameter part 3d of the 2nd sub roller 3 in the periphery again, and wafer A5 is constituted so that it may rotate to a counter direction mutually.

[0014]Next, although the front view of a 3rd embodiment of this invention device is shown in drawing 5 and the top view is shown in drawing 6, This 3rd embodiment is allocated in order from left-hand side with the 1st main roller 1, the 2nd main roller 2, the 2nd sub roller 3, and the 1st sub roller 4, as shown in drawing 5, As shown in drawing 6, the larger diameter part and the small diameter part are provided in each roller like a 2nd embodiment of the above. Wafer A5 is supported in this 3rd embodiment by the larger diameter part 1d of the 1st main roller 1 and the larger diameter part 4d of the 1st sub roller 4 in both sides, Wafer B6 is supported in the larger diameter part 2d of the 2nd main roller 2 and the larger diameter part 3d of the 2nd sub roller 3 which exist inside, and it is constituted so that it may rotate to a counter direction mutually. According to this 3rd embodiment, since a roller is in a symmetrical position to the center of gravity of a wafer, load is uniformly applied to each roller, and stable rotation can be performed, and wear of a roller also has an advantage which becomes uniform.

[0015]Although the front view of a 4th embodiment of this invention device is shown in drawing 7, According to this 4th embodiment, as shown also in that top view slack drawing 8, the left-hand side support disk 7 and the right-hand side support disk 8 were formed in both sides, respectively, and the wafer support groove is established in each larger diameter part of the 1st and 2nd main roller 1 and 2 and the 1st and 2nd sub roller 4 and 3. That is, each support disk is fixed by one fixed axis, enabling free rotation, and it follows and rotates to rotation of a wafer, and it prevents the edge of a wafer moving to a shaft direction by the guide rail formed in the cylinder side. And **** of a wafer is prevented together with the wafer support groove formed in the larger

diameter part of each roller, and unnecessary movement to the shaft direction of a wafer is reduced, and more uniform etching is enabled.

[0016]Although the front view of a 5th embodiment of this invention device is shown in drawing 9 and the top view is shown in drawing 10, In this 5th embodiment, equip the inside right-and-left approximately center and pars-basilaris-ossis-occipitalis approximately center of the etching tub 9 with the ctenidium-like wafer position arrangement member 10, and this prevents **** of a wafer, and. The unnecessary motion to the shaft direction of a wafer is reduced, and more uniform etching is enabled.

[0017]Although the outline explanatory view of an example of the gear train for a drive of said roller used for this invention is shown in drawing 11, The motor shaft 11 was formed in the upper part in the etching tub 9, this motor shaft 11 and the 1st intermediate gear 12 mesh, and, subsequently it has geared in order of the 2nd intermediate gear 13, the rotary roller axis 14, and the driving gear 15.

[0018]Next, although another outline explanatory view of the gear train for a drive and drawing 13 indicate the top view to be the gear train for a drive which showed above-mentioned drawing 11 drawing 12, To what arranges and connected all the gears on the same flat surface, the thing of above-mentioned drawing 11 shifts a gear to shaft orientations, and loses interference, and this gear train for a drive becomes realizable, without this needing the 2nd intermediate gear, and serves as an efficient drive. It becomes easy [the manufacture].

[0019]Although the situation of circulation of the etching reagent at the time of adopting this invention is shown in drawing 14, since an adjacent wafer rotates to a counter direction mutually when based on this invention method, the quantity of motion of an etching reagent is offset in a wafer Manaka center section. Therefore, it becomes easy to circulate between wafers through an etching reagent. The numerals 16 show an air pump among drawing 14.

[0020]

[Effect of the Invention]Since it etches according to this invention, making an opposite direction rotate an adjacent wafer as stated above, the etching reagent inserted between the wafers which rotate to an opposite direction, Even if it does not mix the buffer for rotational movement being offset, and the inflow of the etching reagent from the circumference and an outflow becoming easy, and delaying the etch rate of phosphoric acid etc. also in number of rotations as high as 20-30 rpm, are uniform, A high etch rate can be obtained and productivity can be raised. It means that a wafer interval can be narrowed namely for the inflow of an etching reagent and an outflow to be easy as mentioned above, and processing efficiency's improves. In order to rotate an adjacent wafer comrade to an opposite direction about many wafers put in order at the very small interval in the strong, acid etching reagent as compared with the wafer diameter of 4-5 mm, a simple and positive device is required, but. this invention device fully fills the demand.

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]It is a front view of a 1st embodiment of this invention device.

[Drawing 2]It is a top view of a 1st embodiment of this invention device.

[Drawing 3]It is a front view of a 2nd embodiment of this invention device.

[Drawing 4]It is a top view of a 2nd embodiment of this invention device.

[Drawing 5]It is a front view of a 3rd embodiment of this invention device.

[Drawing 6]It is a top view of a 3rd embodiment of this invention device.

[Drawing 7]It is a front view of a 4th embodiment of this invention device.

[Drawing 8]It is a top view of a 4th embodiment of this invention device.

[Drawing 9]It is a front view of a 5th embodiment of this invention device.

[Drawing 10]It is a top view of a 5th embodiment of this invention device.

[Drawing 11]It is an outline explanatory view showing an example of the gear train for a drive of this invention device.

[Drawing 12]It is an outline explanatory view showing other examples of the gear train for a drive of this invention device.

[Drawing 13]It is a top view showing other examples of the gear train for a drive of this invention device.

[Drawing 14]It is an explanatory view showing circulation of the etching reagent by this invention method.

[Description of Notations]

1 The 1st main roller

2 The 2nd main roller

3 The 2nd sub roller

4 The 1st sub roller

5 Wafer A

6 Wafer B

7 Left-hand side support disk

8 Right-hand side support disk

9 Etching tub

10 Wafer position arrangement member

11 Motor shaft

12 The 1st intermediate gear

13 The 2nd intermediate gear

14 Rotary roller axis

15 Driving gear

16 Air pump

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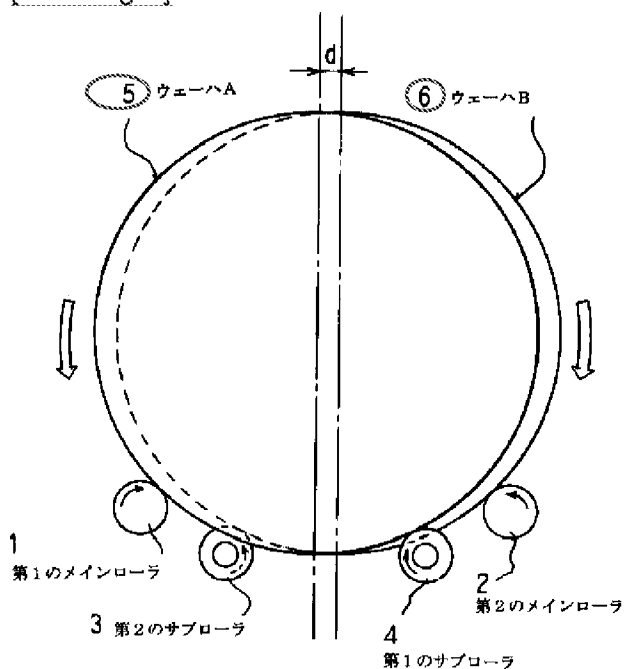
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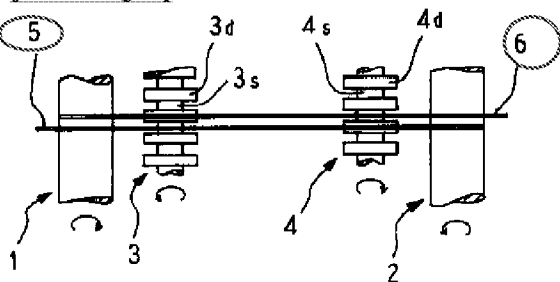
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DRAWINGS

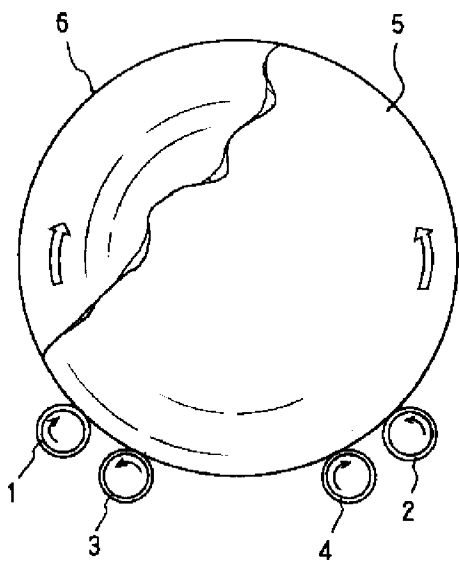
[Drawing 1]



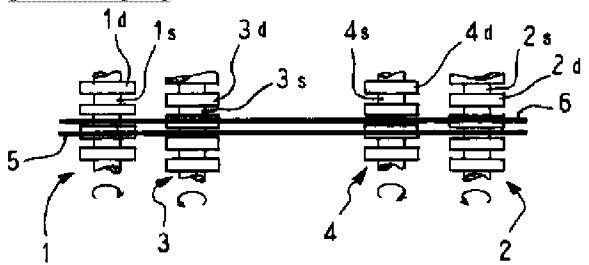
[Drawing 2]



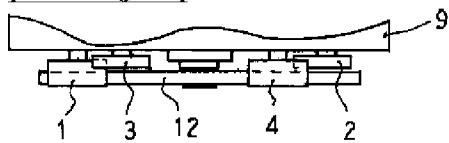
[Drawing 3]



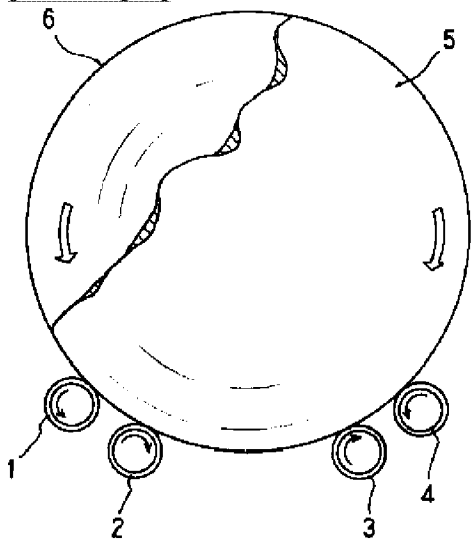
[Drawing 4]



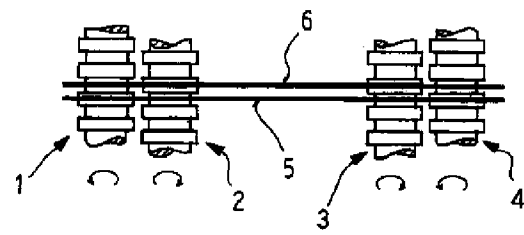
[Drawing 13]



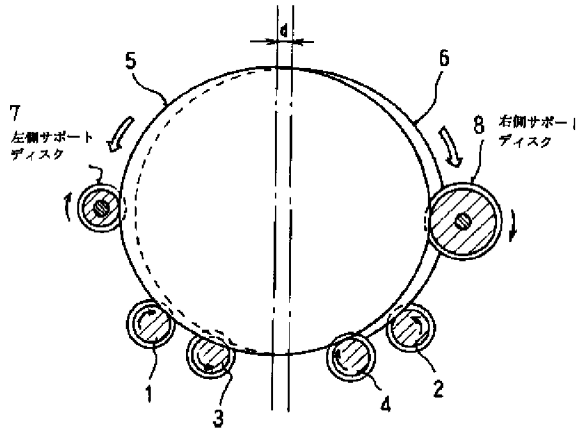
[Drawing 5]



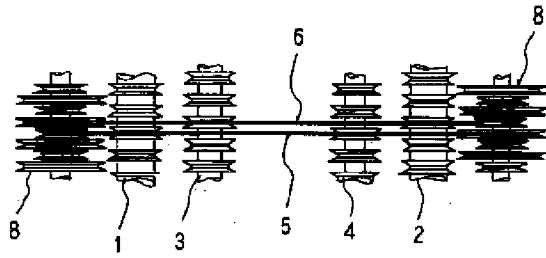
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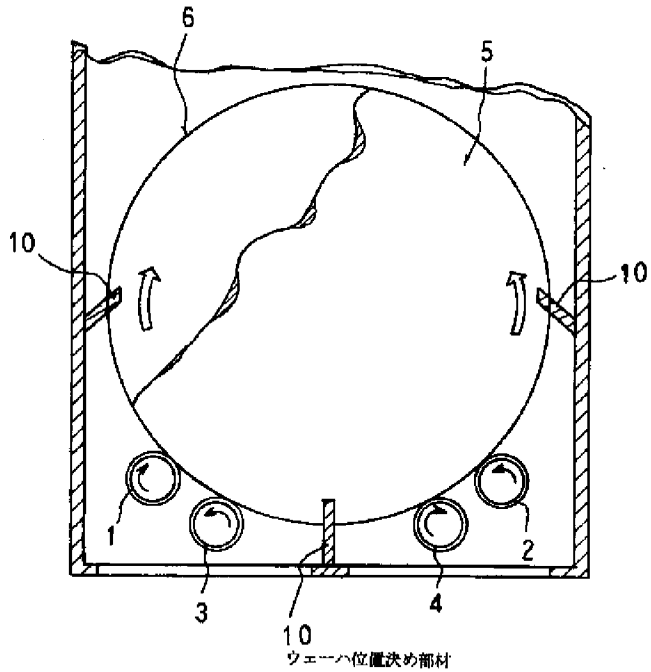
[Drawing 7]



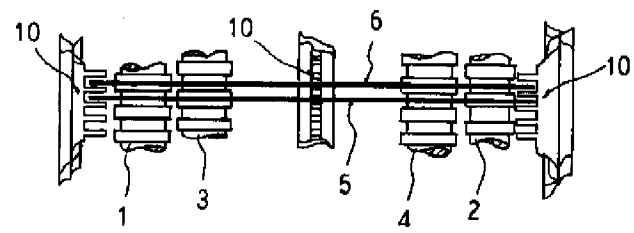
[Drawing 8]



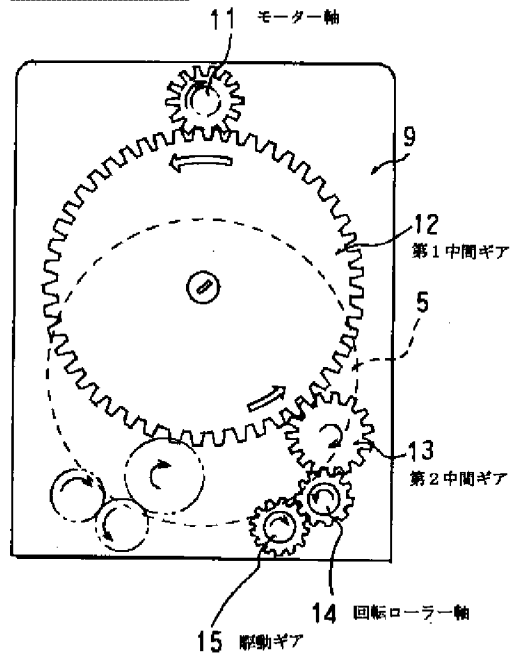
[Drawing 9]



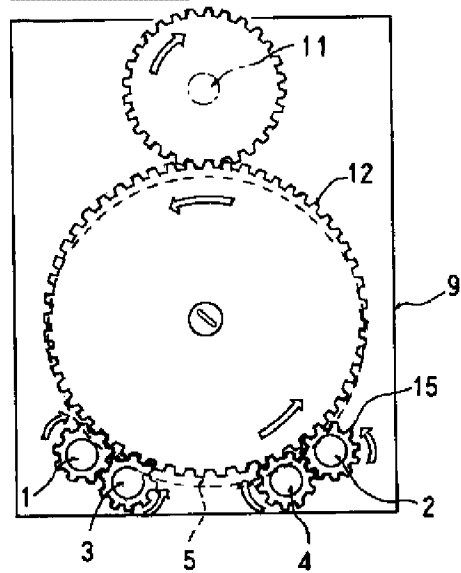
[Drawing 10]



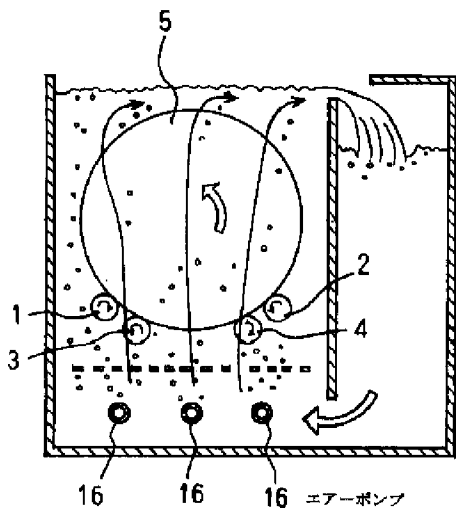
[Drawing 11]



[Drawing 12]



[Drawing 14]



[Translation done.]